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EXAMINER	
GROSS, KENNETH A	

ART UNIT	PAPER NUMBER
2122	8

DATE MAILED: 02/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/489,878	DAS, MANUVIR	
	Examiner	Art Unit	
	Kenneth A Gross	2122	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36 and 52-56* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-36 and 52-56* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Applicant's election with traverse of Claims 37-51, a specific method of graphing variables in a program in Paper No. 6 is acknowledged. The traversal is on the ground(s) that Independent Claims 37, 40, and 41 are directed to a relationship between two nodes similar to the relationship of Claim 1 between two locations, and Claim 47 is directed to a label relationship also similar to the label relationship of the locations of Claim 1. This is not found persuasive because Claim 1 still does not teach graphing variables and generating flow lines between variables as taught in Independent Claims 37, 40, and 41. Claim 1 deals with assignment of variables, whereas Claims 37, 40, and 41 teach forming relationships between nodes by generating flow lines between the nodes. Although Claim 1 does teach labels and a relationship with the content of two variables, Claim 1 does not teach a data member flow to represent a label relationship as taught in Claim 47.

The requirement is still deemed proper and is therefore made FINAL.

Claim Objections

2. Claims 1, 5, 6, and 55 are objected to because of the following informalities: Claim 1 recites "a content of an other of the two locations" on line 6, which should be "a content of [an] the other of the two locations". A similar problem exists in Claims 5, 6, and 55. Claim 1 recites, "propagating a label of the one of the two locations" on line 7, which should be "propagating a label of [the] one of the two locations". Claim 5 contains the same problem. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 1-5 and 7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, it is not clear how a label is "propagated...such that the label of the one of the two locations is a subset of the other of the two locations". The specification reiterates this statement on Page 11, lines 26-28 but gives no explanation on how the propagation is performed or why it is performed. This argument is similarly applied to Claims 5 and 7. Claims 2-4 are rejected for being dependent on a rejected parent Claim.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 9-11, 15, 16, 20, 21, 25, 26, 30, 31, and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, Claims 9-11 make frequent reference to the term "level", but it is not clear from the claim as to what a level is in the context of these claims. Is the level some range of logical or physical addresses that correspond to the locations mentioned in Claims 9-11? Claims 15, 20, 25, and 30 recite "the first location points to the other of the two locations". However, the claim already states that only two locations are

formed. Does this claim simply imply that each of the two locations points to the other? Claims 16, 21, 26, and 31 recite, "determining that the program is correctly typed". What does it mean for a program to be correctly typed? Finally, the term "about linearly proportional" on line 2 of Claim 54 is indefinite in that it is does not define an exact proportion.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claim 6, 8-11, and 52-54 are rejected under 35 U.S.C. 102(b) as being anticipated by "Points-to Analysis in Almost Linear Time" by Bjarne Steengaard, Conference Record of the Twenty-Third ACM Symposium on Principles of Programming Languages, January 1996, page 32-41 (hereinafter Steengaard).

In regard to Claim 6, Steengaard teaches: (a) forming a location for at least one variable in the program, wherein the location includes a label and a content (Figure 1, and Page 33, Column 2, lines 35-41); (b) and defining a relationship between two locations...wherein contents of the two locations are selectively unified (Figure 3, Equation 1).

In regard to Claim 8, Steengaard teaches forming a location containing a pointer to a another location, and the other location defines a pointed-to location (Figure 3, Equation 2). X = &Y shows that X contains a reference to a location, and that Y is that pointed-to location.

In regard to Claim 9, Steengaard teaches defining at least one level where the level is defined by at least one location, wherein a pointed-to location of the one location defines another level (Figure 4). In this figure, variable a's relationship with variable x, as well as variables b and c's relationship with y define one level, where variable b's relationship with variable z defines another level, since pointed-to location y points to pointed-to location z.

In regard to Claim 10, Steengaard teaches defining a relationship between two locations that are in the same level (Figure 4). Variable y and Variable z are two locations on the same level that have a relationship.

In regard to Claim 11, Steengaard teaches defining a relationship between tw locations on different levels (Figure 4). Variable b and variable z define locations on different levels that share a relationship.

In regard to Claim 52, Steengaard teaches: (a) processing a plurality of assignment statements in a program to derive a plurality of sets of information, wherein the plurality of sets of information is distributed among a plurality of levels of indirection (Figure 4); (b) unifying selectively sets of information in at least one level of indirection so as to allow a desired level of analytical precision within a desired duration of pointer analysis (Figure 5, Equation 1 and Page 35, Section 5.2).

In regard to Claim 53, Steengaard teaches in Figure 5, Equation 1 that if $T_1 \neq T_2$ the **cjoin**(T_1 , T_2), which implies that the sets will be unified up to the first level of indirection.

In regard to Claim 54, Steengaard teaches that the desired duration of pointer analysis is about linearly proportional to the size of the program (Page 37, Column 1, lines 1-3).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1-5, 7, 12-14, 16-19, 21-24, 26-29, and 31-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Points-to Analysis in Almost Linear Time" by Bjarne Steengaard, Conference Record of the Twenty-Third ACM Symposium on Principles of Programming Languages, January 1996, page 32-41 (hereinafter Steengaard) in view of "Partial Online Cycle Elimination in Inclusion Constraint Graphs" by Manuel Fahndrich et al., Proceedings of the ACM SIG-PLAN '98 Conference on Programming Language Design and Implementation (PLDI), Montreal, Canada, June 1998 (hereinafter Fahndrich).

In regard to Claim 1, Steengaard teaches (a) processing an assignment between two variables in a program...with a content of the other of the two locations (Page 35, Figure 3, Equation 1). Steengaard does not teach propagating a label of the one of the two locations to a label of the other of the two locations such that the label of the one of the two locations is a subset of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to process an assignment between two variables in a program where the variables contain labels, as taught by Steengaard, where the label of one variable is propagated such that one variable label is a subset of another variable label, as taught by Fahndrich, since if both

variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

In regard to Claim 2, it would be obvious to delay propagation, since altering the name of a variable while the variable is in use will alter the results of the assignment, and produce invalid results.

In regard to Claim 3, Fahndrich teaches forming a points-to graph to graphically display assignments (Page 5, Column 1, lines 19-26).

In regard to Claim 4, Fahndrich teaches forming nodes and flow lines to indicate relationships between locations (Page 5, Column 1, lines 19-26).

Claim 5 is a medium Claim that corresponds to method Claim 1, and Claim 5 is rejected for the same reasons as Claim 1, where it would be obvious to provide a medium to implement the method of Claim 1, since Claim 1 deals with enhancing computer software pointers.

In regard to Claim 7, Steengaard teaches the method of Claim 6, but does not teach propagating a label of the one of the two locations to a label of the other of the two locations such that the label of the one of the two locations is a subset of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method of Claim 6, as taught by Steengaard, where the label of one variable is propagated such that one variable label is a subset of another variable label, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

In regard to Claim 12, Steengaard teaches: (a) forming a location for at least one variable in the program, wherein the location includes a label and a content (Figure 1, and Page 33, Column 2, lines 35-41); (b) forming a relationship between two locations upon an assignment of a first and second variable in the program and wherein the contents of the two locations are selectively unified (Figure 3, Equation 1). Steengaard does not teach that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method of forming a location for at least one variable in the program, wherein the location includes a label and a content and forming a relationship between two locations upon an assignment of a first and second variable in the program and wherein the contents of the two locations are selectively unified, as taught by Steengaard, where that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

Claim 13 contains a limitation that has already been addressed in the rejection of Claim 8, and Claim 13 is rejected for the same reason as Claim 8.

In regard to Claim 14, Steengaard teaches assigning a second variable y to first variable x (Figure 3, Equation 1).

In regard to Claim 16, Steengaard teaches determining that the program is correctly typed given that the second variable is assigned to the first variable and wherein a content of the

pointed-to location is selectively unified with a content of the second location (Figure 3, Equation 1). Steengaard does not teach that the determination is made if and only if the label of a pointed-to location of the second location is a subset of a label of a pointed-to location of the first location. Fahndrich, however, does teach that the constraint that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method of Claim 15, further determining that the program is correctly typed given that the second variable is assigned to the first variable and wherein a content of the pointed-to location is selectively unified with a content of the second location, as taught by Steengaard, where the determination is made if and only if the label of a pointed-to location of the second location is a subset of a label of a pointed-to location of the first location, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

In regard to Claim 17, Steengaard teaches: (a) forming a location for at least one variable in the program, wherein the location includes a label and a content (Figure 1, and Page 33, Column 2, lines 35-41); (b) forming a relationship between two locations upon an assignment of a first variable and an address of a second variable in the program and wherein the contents of the two locations are selectively unified (Figure 3, Equation 2). Steengaard does not teach that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the

method of forming a location for at least one variable in the program, wherein the location includes a label and a content and forming a relationship between two locations upon an assignment of a first variable and the address of a second variable in the program and wherein the contents of the two locations are selectively unified, as taught by Steengaard, where that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

Claims 18, 19, and 21 contain limitations that have already been addressed in the rejections of Claims 13, 14, and 16, and Claims 18, 19, and 21 are rejected for the same reasons as Claims 13, 14, and 16, respectively.

In regard to Claim 22, Steengaard teaches: (a) forming a location for at least one variable in the program, wherein the location includes a label and a content (Figure 1, and Page 33, Column 2, lines 35-41); (b) forming a relationship between two locations upon an assignment of a first variable and an dereference of a second variable in the program and wherein the contents of the two locations are selectively unified (Figure 3, Equation 3). Steengaard does not teach that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method of forming a location for at least one variable in the program, wherein the location includes a label and a content and forming a relationship between two locations upon an

assignment of a first variable and the dereference of a second variable in the program and wherein the contents of the two locations are selectively unified, as taught by Steengaard, where that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

Claims 23, 24, and 26 contain limitations that have already been addressed in the rejections of Claims 13, 14, and 16, and Claims 23, 24, and 26 are rejected for the same reasons as Claims 13, 14, and 16, respectively.

In regard to Claim 27, Steengaard teaches: (a) forming a location for at least one variable in the program, wherein the location includes a label and a content (Figure 1, and Page 33, Column 2, lines 35-41); (b) forming a relationship between two locations upon an assignment of the dereference of a first variable and a second variable in the program and wherein the contents of the two locations are selectively unified (Figure 3, Equation 6). Steengaard does not teach that the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations. Fahndrich, however, does teach that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to perform the method of forming a location for at least one variable in the program, wherein the location includes a label and a content and forming a relationship between two locations upon an assignment of a dereference of a first variable and a second variable in the program and wherein the contents of the two locations are selectively unified, as taught by Steengaard, where that the

relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations, as taught by Fahndrich, since if both variables are pointers, the left hand variable now points to the set of variables that the right hand variable points to, which makes the right hand set a subset of the left hand set.

Claims 28, 29, and 31 contain limitations that have already been addressed in the rejections of Claims 13, 14, and 16, and Claims 28, 29, and 31 are rejected for the same reasons as Claims 13, 14, and 16, respectively.

Claim 32 is a medium claim that corresponds to method Claim 12, and Claim 32 is rejected for the same reasons as Claim 12, where it would be obvious to provide a medium to implement the method of Claim 12, since Claim 12 deals with enhancing computer software pointers.

In regard to Claim 33, Steengaard teaches forming a relationship between two pointers, as in pointer b and pointer y in Figure 4 on Page 35.

In regard to Claim 34, Steengaard teaches an assignment between a first variable and the address of a second variable in the program (Figure 3, Equation 2).

In regard to Claim 35, Steengaard teaches an assignment between a first variable and the dereference of a second variable in the program (Figure 3, Equation 3).

In regard to Claim 36, Steengaard teaches an assignment between a dereference of a first variable and a second variable in the program (Figure 3, Equation 6).

11. Claims 55 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Partial Online Cycle Elimination in Inclusion Constraint Graphs" by Manuel Fahndrich et al.,

Proceedings of the ACM SIG-PLAN '98 Conference on Programming Language Design and Implementation (PLDI), Montreal, Canada, June 1998 (hereinafter Fahndrich).

In regard to Claim 55, Fahndrich teaches a source file containing at least one relationship in an assignment statement in a program, wherein the relationship defines that a set of symbols relating to one of the two variables is a subset of a set of symbols relating to the other of the two variables. Fahndrich teaches that the name of one variable, X_{la}, contains at least the name of the other variable X_{lb} (Page 6, Column 1, lines 9-17). Fahndrich does not teach a compiler to compile the source file, a builder to build a tree that represents the source file, and an analyzer to produce an object file from the tree. However, compiling, building, and analyzing as described by the claim are inherent steps in producing an executable program from source code, and it would be obvious to transform a source code into an executable program by means of a compiler, builder, and analyzer.

In regard to Claim 56, linking is an obvious step in the compilation process when multiple files in a single program are combined together, and a linker would be an obvious addition to the system of Claim 55.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kenneth A Gross whose telephone number is (703) 305-0542. The examiner can normally be reached on Mon-Fri 7:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q Dam can be reached on (703) 305-4552. The fax phone number for the organization where this application or proceeding is assigned is (703) 746-7239.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

KAG

TUAN DAM
SUPERVISORY PATENT EXAMINER